

Clarifying the type locality of *Liotyphlops wilderi* (Garman, 1883) (Serpentes, Anomalepididae), with comments on other reptiles from São Cyriaco, Minas Gerais

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Abstract

The snake species *Typhlops wilderi* (today *Liotyphlops wilderi*) was described in 1883 based on specimens from São Cyriaco, in Minas Gerais, Brazil. The name of this type locality has been cited in different ways in the literature, making its geographic location confusing. Solving this question is an important issue for future taxonomy and systematic studies. After searching for information on the collector of the type series of *L. wilderi* (John Casper Branner) using the Google Scholar database, I found that São Cyriaco was a gold mining company located in the current municipality of Alvorada de Minas. Besides elucidating the type locality of *L. wilderi*, I searched for reptile specimens collected by Branner, deposited in collections registered at the VertNet Portal and SpeciesLink, and personally examined the extant material from Minas Gerais.

Key Words

Amphisbaenia, lizards, Natural History Museum, snakes, Squamata, taxonomy

Introduction

In zoological nomenclature, the type locality of a species or subspecies is the geographical (and, sometimes, stratigraphical) place of capture, collection, or observation of the name-bearing type (holotype, lectotype, neotype, or syntypes), “the objective standard of reference whereby the application of the name of a nominal taxon can be determined” (International Commission on Zoological Nomenclature 1999). It is not uncommon, however, that taxa have an uncertain or somewhat vague (e.g., “Brazil”) type locality, especially those described more than a century ago (e.g., Frost 2021; Uetz et al. 2021). A well-defined type locality is of great importance to taxonomy and systematics. If populations attributed to a single species are found to diverge sufficiently (morphologically and/or genetically, for example) to be considered two or more

subspecies or species, the population most closely related to the name-bearing type will retain the taxon name (e.g., Sturaro et al. 2018; Ascenso et al. 2019; Perez and Borges-Martins 2019). In the current “genomic era”, many historical herpetological type specimens, usually formalin-fixed, lack genetic samples, and extracting and sequencing DNA from them is still complex (Bell et al. 2020). In such cases, samples from topotypes, i.e., new specimens from (or close to) the type locality, can be a valuable contribution to systematics (Fouquet et al. 2016; Bell et al. 2020; Mângia et al. 2020). But if the type locality is uncertain or too vague, it becomes difficult to assign proper names to clades (Cacciali et al. 2018).

The snake species *Liotyphlops wilderi* (Garman, 1883) (originally *Typhlops wilderi*) is known from a few specimens from Bahia, Minas Gerais and Rio de Janeiro states, Brazil (Nogueira et al. 2019) and there is confusing

information regarding its type locality. Specimens used in the original description were said to have been collected at “São Cyriaco, Brazil” (Garman 1883). Later, the locality name was cited as “Cyriaco, near Serra Providencia, Minas Geraes, Brazil” (Hammar 1908), “São Cyprião, Minas Geraes, Brazil” (Barbour and Loveridge 1929; Marx 1958; Gans 1966; Dixon and Kofron 1983), “Cipriano, Minas Gerais State, SE Brazil, 19°45'S, 43°57'W, elevation 850 m” (a location within the city of Vespasiano) (Wallach et al. 2014), and “São Cyriaco, near the village of Santo Antônio do Rio do Peixe. Currently, Alvorada de Minas” (Nogueira et al. 2019).

Besides being the type locality of *Typhlops wilderi*, São Cyriaco is the locality of the collection of a wormlizard specimen assigned to *Amphisbaena prunicolor* (Cope 1885) (Gans 1966) a species mostly distributed in southern Brazil, Paraguay, and Argentina (Perez et al. 2012). This raises questions regarding the identity of the specimen (whether it was misidentified) and the geographic location of São Cyriaco (if it could somehow be in southern, instead of southeastern Brazil).

The wormlizard specimen and the type series of *Liotyphlops wilderi* were collected by the geologist John Casper Branner (1850–1922). Born in New Market, U.S.A., from a distinguished family, Branner entered Cornell University in 1870, where he met the geologist Charles Hartt, who invited him for a trip to Brazil in 1874 (Penrose 1925). This expedition set the stage for the Comissão Geológica do Império do Brasil (Geological Commission of the Brazilian Empire), with Hartt as its director and Branner as his assistant from 1875 to 1877 (Penrose 1925). Following the termination of the commission, in 1879 and 1880 Branner became assistant of the mining engineer James E. Mills, who was superintendent of a U.S. mining company in the state of Minas Gerais (Branner 1902). He returned to his home country in 1880, but a few months later came back to Brazil, employed by the inventor Thomas A. Edison to search for a vegetable fiber to strengthen incandescent lights (Penrose 1925). In 1882, working for the U.S. Department of Agriculture, Branner traveled to study the insects affecting cotton and sugar cane cultures in Brazil (Penrose 1925; Oliveira 2014).

In 1899, as a professor at Stanford University, Branner returned to Brazil with collaborators for the ‘Branner-Agassiz Expedition’, funded by Alexander Agassiz (son of Louis Agassiz), to study the geology of ocean reefs, atolls, and volcanic islands, besides zoology (particularly ichthyology) traveling along the coast of Rio Grande do Norte and Bahia states (northeastern Brazil) and visiting islands such as the Fernando de Noronha archipelago (Penrose 1925; Oliveira 2014). Another visit occurred in 1907 to study the black diamonds districts of Bahia and the geology of Alagoas and Sergipe states, also in northeastern Brazil (Penrose 1925). In 1911, Branner led the ‘Stanford Expedition to Brazil’ (or ‘Hopkins-Branner Expedition’ (Schmidt and Inger 1951)), intended to explore the Brazilian coast from the northeast to the mouth of the Amazon river, in the north (Oliveira 2014).

The original objectives were not accomplished, but the team made geological and zoological collections in the states of Rio Grande do Norte, Ceará, Pará, Amazonas, and Rondônia, as well as Bolivia (Oliveira 2014, 2018).

Despite being a geologist, Branner was trained as a naturalist, making observations, and collecting material other than of geological interest, even before his interdisciplinary expeditions as a professor at Stanford. This led to the publication, for example, of an account of the identification of the supposedly deadly peanut-headed lantern fly (*Fulgora lanternaria*) (Branner 1885) and of notes on the fauna of Fernando de Noronha (Branner 1888). He also collected specimens that would later become the types of new species, like the treefrog *Dendropsophus branneri* (Cochran, 1948) and the aforementioned snake *Liotyphlops wilderi*. To find the correct name and current location of São Cyriaco, type locality of *L. wilderi*, I decided to investigate in more detail the life and work of J. C. Branner. Additionally, I aimed to examine the specimen identified as *Amphisbaena prunicolor* collected by Branner at São Cyriaco, as well as other reptile specimens from the same locality housed in natural history collections.

Methods

With the intention of finding published records that could shed light on the geographic location and the current name of the type locality of *Liotyphlops wilderi*, in early 2019 I used the Google Scholar database to search for the following keywords: “São Cyriaco” AND Branner; “São Cyprião” AND Branner; “Cyprião” AND Branner; “Cypriano” AND Branner. I also searched at the VertNet Portal (<http://portal.vertnet.org>) and SpeciesLink (<https://specieslink.net>) for reptile specimens collected by J. C. Branner, deposited in collections registered in those databases, and in April 2019 I personally examined the extant specimens, all deposited in U.S. museums. To ensure a proper identification of these specimens, I compared their external morphology (mainly scale counts, but also the color pattern and measurements when necessary) with the original descriptions or updated taxonomic studies (Gans 1966; Roze 1967; Peters and Donoso-Barros 1970; Peters and Orejas-Miranda 1970; Dixon and Kofron 1983; Dixon 1989; Etheridge and Williams 1991; Silva and Sites 1999; Vanzolini 2002; Campbell and Lamar 2004; Rodrigues et al. 2006; Centeno et al. 2010; Perez et al. 2012; Costa et al. 2015, 2019; Breitman et al. 2018; Santos and Reis 2018). I took measurements; snout-vent length (SVL) and tail length (TL), with a ruler to the nearest millimeter and photographs in dorsal view of all but one of the specimens (one syntype of *L. wilderi*), for the purpose of illustration.

Results and discussion

The search for the correct name and location of the type locality of *Liotyphlops wilderi* was successful. As stated



Figure 1. Map of the municipality of Alvorada de Minas, state of Minas Gerais, Brazil, type locality of *Liotyphlops wilderi*, where the São Cyriaco Gold Mining Company was established in the 19th century. The star is placed over the city of Alvorada de Minas.

in the original description (Garman 1883) São Cyriaco is the correct name. The São Cyriaco Gold Mining Company of Boston received authorization from the Brazilian Empire for operation at Minas Gerais in 1878 (Senado Federal 1878). The mining was established close to the village of Santo Antônio do Rio do Peixe, an area said to contain fertile soil, many fields, hills, and forests (Mills 1878). John Casper Branner worked in São Cyriaco in 1879 and 1880 as an interpreter and assistant engineer to superintendent James E. Mills (Branner 1902). The village of Santo Antônio do Rio do Peixe later became a district of the municipality of Serro, and in 1962 became a separate municipality named Alvorada de Minas (Carvalho 2018; Neves and Simões 2021) (18.72°S, 43.37°W) (Fig. 1). This information is briefly cited, without details, by Nogueira et al. (2019). Hammar (1908) cites “Cyriaco, near Serra Providencia”. The mines of São Cyriaco were located in the Espinhaço Mountain range (Gontijo 2008), but I did not find any reference to a ‘serra’ (mountain) named Providência in the region. It may be possible that its name has changed.

Only 18 squamate reptiles collected by John C. Branner in Minas Gerais are registered at VertNet and six are registered at SpeciesLink (all of the latter are at VertNet). Those specimens were deposited at the collections of the Field Museum (FMNH) (one specimen), the Museum of Comparative Zoology (MCZ) (six specimens), and the Cornell University Museum of Vertebrates (CUMV) (11 specimens). The specimens were collected by Branner before he became a professor at Stanford University, when he was working at São Cyriaco Gold Mining Company. He sent the specimens to his alma mater, Cornell University, whence some were later exchanged with the

MCZ. One syntype of *L. wilderi* was sent from MCZ to the FMNH, according to the collections’ catalogues. Unfortunately, one specimen from MCZ and all but three specimens from CUMV are missing (Charles M. Dardia, in litt., 2019). Therefore, to the best of my knowledge, only nine specimens of reptiles collected by J. C. Branner in Minas Gerais remain in museum collections. Below, I provide information on those specimens, all personally examined, and discuss reidentifications when needed.

ANOMALEPIDIDAE

Liotyphlops wilderi (Garman, 1883). Two specimens. MCZ R-5126 (syntype) (Fig. 2A). Minas Gerais, São Cyriaco. Sex unknown; SVL 163 mm; TL 5 mm. FMNH 73387 (syntype). Minas Gerais, São Cyriaco. Sex unknown; SVL 156 mm; TL 4.6 mm.

ELAPIDAE

Micrurus corallinus (Merrem, 1820). Two specimens. CUMV 1925 (Fig. 2B). Minas Gerais, São Cyriaco. Male. SVL 415 mm; TL 66 mm. MCZ R-5568 (Fig. 2C). Minas Gerais, São Cyriaco. Male; SVL 350 mm; TL 61 mm.

Micrurus frontalis (Duméril, Bibron & Duméril, 1854). One specimen. CUMV 1928 (Fig. 2D). Minas Gerais, São Cyriaco. Sex unknown; SVL ~300 mm; TL 21 mm. The specimen is desiccated, making the SVL measurement less precise. It was originally identified as *M. lemniscatus* Linnaeus, 1758. Despite its poor condition, a pattern of black triads is visible at some parts of the



Figure 2. Reptiles collected by John Casper Branner in Minas Gerais between 1878 and 1879. **A.** *Liotyphlops wilderi* (MCZ R-5126, syntype); **B.** *Micrurus corallinus* (CUMV 1925); **C.** *Micrurus corallinus* (MCZ R-5568); **D.** *Micrurus frontalis* (CUMV 1928); **E.** *Erythrolamprus maryellenae* (CUMV 1930); **F.** *Amphisbaena metallurga* (MCZ R-5124); **G.** *Enyalius bilineatus* (MCZ R-5567); **H.** *Urostrophus vaultieri* (MCZ R-5566). Scale bars: 10 mm.

body. Among the *Micrurus* species known for the region, only *M. frontalis* and *M. carvalhoi* Roze, 1967 (formerly *M. lemniscatus carvalhoi*) show a triad pattern (Campbell and Lamar 2004; Nogueira et al. 2019), and can be distinguished from each other mainly by the presence of a light band on the snout of *M. carvalhoi*, absent in *M. frontalis*.

DIPSADIDAE

Erythrolamprus maryellenae (Dixon, 1985). One specimen. CUMV 1930 (Fig. 2E). Minas Gerais, São Cyriaco. Sex unknown; SVL 280 mm; TL 90 mm. The specimen was identified as *Liophis merremii* (= *Erythrolamprus miliaris merremii* (Wied, 1821)). I reidentified it as *E. maryellenae* by its having 19-19-17 dorsal scale rows without apical pits, 152 ventrals, a divided cloacal shield, 66 paired subcaudals, eight supralabials (fourth and fifth contacting the eye), and 10 infralabials (Dixon 1989).

AMPHISBAENIDAE

Amphisbaena metallurga Costa, Resende, Teixeira Jr., Dal Vechio & Clemente, 2015. One specimen. MCZ R-5124 (Fig. 2F). Minas Gerais, São Cyriaco. Sex unknown; SVL 123 mm; TL 14 mm. Garman (1883) cited three specimens (with no collection catalogue information) of *Amphisbaena darwinii* Duméril & Bibron, 1839, one of which may be MCZ R-5124 (the other two may be lost and I did not find any additional record of them). Gans (1966) examined MCZ R-5124 and identified it as *A. prunicolor* (Cope, 1885). Specimens of *Amphisbaena prunicolor* have a dark purplish-brown color that fades to pale brown in preservative. The color pattern is still clearly visible in the holotype (Academy of Natural Sciences, Philadelphia; ANSP 12969), collected in late 19th century (Perez et al. 2012). In contrast, MCZ R-5124 presents a uniform cream color pattern. Furthermore, *A. prunicolor* exhibits a row of postmalar scales (Gans 1966; Perez et al. 2012), absent in MCZ R-5124. Gans (1966) noted this, as can be seen in the document with the character data for each specimen he examined (Document Number 8998 in the Library of Congress, Washington, D.C., U.S.A.). There, Gans noted “2+4[8]” for the “chin segments” of MCZ R-5124. The brackets indicate a row of scales posterior to the mouth commissure, which should not be counted as a postmalar row but rather as the first body annulus, as can be seen in his annotations of *A. albocingulata* Boettger, 1885. The color pattern and the morphology of MCZ R-5124 (205 body annuli, three lateral annuli, 19 caudal annuli, autotomic site at 8th caudal annulus, lateral sulcus present, dorsal and ventral sulci absent, 12 dorsal and 14 ventral segments at a midbody annulus, four pre-cloacal pores sequentially arranged, three supralabials, three infralabials, two scales on first postgenial row, four scales on second postgenial row, and no postmalars) best

fit the diagnosis of *Amphisbaena metallurga*, whose type locality is Conceição do Mato Dentro, a neighboring municipality south of Alvorada de Minas (Costa et al. 2015, 2019). MCZ R-5124 increases the range of body annuli of *A. metallurga* from 185–199 to 185–205 and the range of caudal annuli from 23–25 to 19–25. Therefore, the record of *Amphisbaena prunicolor* for São Cyriaco, Minas Gerais, is here invalidated.

LEIOSAURIDAE

Enyalius bilineatus Duméril & Bibron, 1837. One specimen. MCZ R-5567 (Fig. 2G). Minas Gerais, unknown locality. Sex unknown; SVL 77 mm; TL 168 mm (tip broken).

Urostrophus vautieri Duméril & Bibron, 1837. One specimen. MCZ R-5566 (Fig. 2H). Minas Gerais, unknown locality. Sex unknown; SVL 76 mm; TL 95 mm.

According to the collection catalogues, the nine missing specimens were: 1) CUMV 1926, Minas Gerais, São Cyriaco – recorded as *Erythrolamprus aesculapii monozona* (Jan, 1863) (Serpentes: Dipsadidae); the taxonomy of *E. aesculapii* needs clarification (Curcio et al. 2015), but the name *E. a. venustissimus* (Wied, 1821) has been used for non-Amazonian populations, including for morphs with fused black rings (Costa and Bérnils 2018). 2) CUMV 1924, Minas Gerais, São Cyriaco – recorded as *Elapomorphus quinquelineatus* (Raddi, 1820) (Serpentes: Dipsadidae). 3–4) CUMV 1927 and 1939, Minas Gerais, São Cyriaco – recorded as *Oxyrhopus trigeminus* Duméril, Bibron & Duméril, 1854 (Serpentes: Dipsadidae), possibly correct, but we cannot dismiss *Oxyrhopus guibei* Hoge & Romano, 1978, described almost a century after the specimen’s collection, quite similar to *O. trigeminus* (Zaher and Caramaschi 1992) and also expected to occur in the region (Nogueira et al. 2019). 5) CUMV 1931, Minas Gerais, São Cyriaco – recorded as *Liophis reginae* (Linnaeus, 1758) (= *Erythrolamprus reginae*; Serpentes: Dipsadidae), most probably *Erythrolamprus macrosoma* (Amaral, 1935), formerly a subspecies of *E. reginae* that recently received full species status and is expected to occur in the region, contrary to *E. reginae* sensu stricto (Ascenso et al. 2019). 6–7) CUMV 1933 and 1935, Minas Gerais, São Cyriaco – recorded as *Liophis cobella* (Linnaeus, 1758), (= *Erythrolamprus cobella*; Serpentes: Dipsadidae) today restricted to northern South America (Nogueira et al. 2019); no species of the *E. cobella* group is expected to occur in the region (Fernandes et al. 2002) and possibly the referred specimens are *E. poecilogyrus poecilogyrus* (Wied, 1824), a common species in southeastern Brazil (Nogueira et al. 2019). 8) CUMV 1936, Minas Gerais, São Cyriaco – one syntype of *Typhlops wilderi* Garman, 1883 (Serpentes: Anomalepididae). 9) MCZ R-144556, Minas Gerais, unknown locality – *Enyalius bilineatus* (Iguania: Leiosauridae).

Minas Gerais has one of the richest reptile fauna among Brazilian states (Costa et al. 2022), probably

related to its large area and presence of varied ecoregions (Drummond et al. 2005). During the 19th century, Minas Gerais was visited by naturalists who traveled mainly along the mining districts of the Espinhaço mountain range (Papavero 1971). John C. Branner was a geologist but collected reptile specimens while working for the São Cyriaco Gold Mining Company, in the Espinhaço range. Unfortunately, half of the 18 specimens collected by him in Minas Gerais that had been catalogued in museums are lost. But the remaining material includes valuable specimens such as two syntypes of *Liotyphlops wilderi* and a wormlizard reidentified here as *Amphisbaena metallurga*, a recently named taxon. São Cyriaco (now Alvorada de Minas) is the fifth locality from which *A. metallurga* is known to occur (Costa et al. 2015, 2019; Dal Vechio et al. 2018), and all but one (Morro do Pilar) previous records of this species are in areas impacted by mining activities.

In the so called ‘century of extinctions’, when biodiversity is facing a crisis by human activities (Ceballos et al. 2015), taxonomy is crucial for conservation biology (Dubois 2003; Hortal et al. 2015). In this regard, reviewing and updating information on doubtful type localities is important to overcome some problems that hamper advances in taxonomy and systematics (Bell et al. 2020). *Liotyphlops wilderi* has a relatively broad geographic range (Nogueira et al. 2019), although being known from few specimens (Centeno et al. 2010; Santos and Reis 2018). The two remaining syntypes are discolored, dissected, and lack genetic samples. Knowing the exact type locality will allow the future collection of topotypes. Such new specimens would be useful for a morphological reanalysis of the species and its inclusion in molecular phylogenies. If future research finds that specimens assigned to *L. wilderi* belong to more than one species, specimens from its type locality will be very important.

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